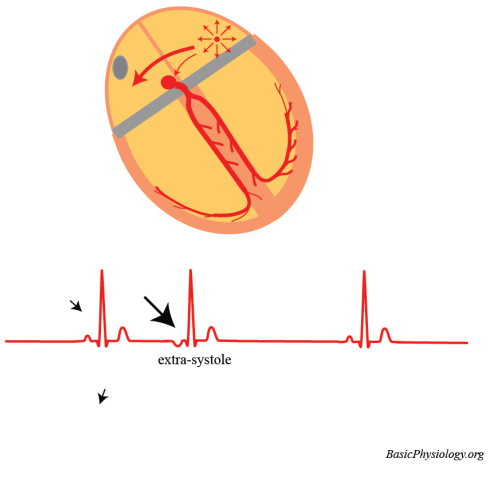
B.7.4. Supraventricular Arrhythmias

Introduction

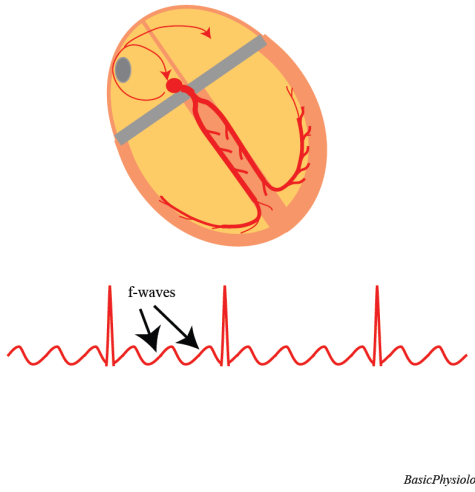
1. Arrhythmias are usually divided into those that occur in the ventricles and those that occur in the atrium, above the ventricles, also called "supra-ventricular".	2. The major **supra-ventricular** arrhythmias are: 1. Atrial extra-systole 2. Atrial flutter 3. Atrial tachycardia 4. AV-nodal tachycardia 5. Atrial fibrillation
3. The major **ventricular** arrhythmias are: a. Ventricular extra-systole b. Ventricular tachycardia c. Ventricular fibrillation. *(see next page)*	4. There are a few arrhythmias that do not fit into one of these two groups. The most famous one is the WPW syndrome (=Wolf-Parkinson-White*; see next page*).
5. Also, the **duration** of the arrhythmia is important.	6. There are three types: - **Paroxysmal**: lasts for seconds to a few hours - **Persistent**: lasts for days to weeks - **Chronic**: lasts months to years.

Supra-ventricular Arrhythmias

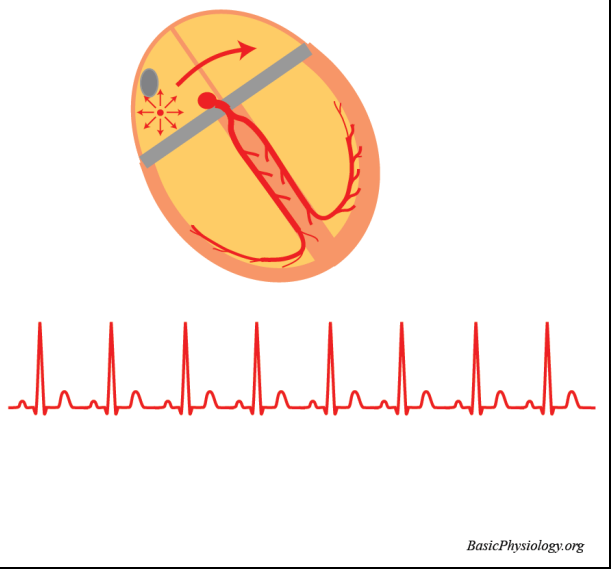
A. Atrial Extra systole

1. Atrial extra systole is when an "extra" beat occurs. In other words, an extra beat is "inserted" between the regular beats.	2. Because the origin of this extra-systole could occur anywhere in the atria, right or left, the P wave and the PQ-interval may be different from the normal P wave.
3. In this example, the focus was located in the left atrium. Therefore, the major direction of propagation is now opposite from the normal direction; hence the P-wave becomes opposite to the normal polarity (i.e., negative).	
4. Note that the QRS and T waves are normal. This is because the extra impulse, after entering the AV-node, will propagate through the major Purkinje pathways in the same manner as the normal impulses.	

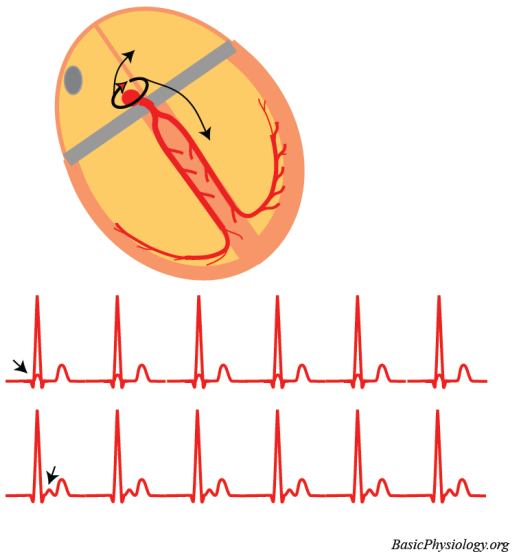
B. Atrial Flutter

1. In atrial flutter, there is a large re-entrant circuit, usually in the right atrium. This circuit revolves much faster than the normal sinus rhythm; hence it forms a tachycardia.	2. From the revolving circuit, impulses regularly propagate to the left atrium. These waves are visible as undulating F-waves on the ECG (F=flutter).
3. The circuit rotates too quickly for the AV-node (which has a long refractory period) so not all impulses propagate through the AV-node but are blocked.	
4. Now and then, when the AV-node has sufficiently recovered, an impulse propagates through the Purkinje system to the ventricles.	
5. Therefore, the QRS complex has a normal shape. The T-wave is often hidden by the flutter f-waves as in this example.	

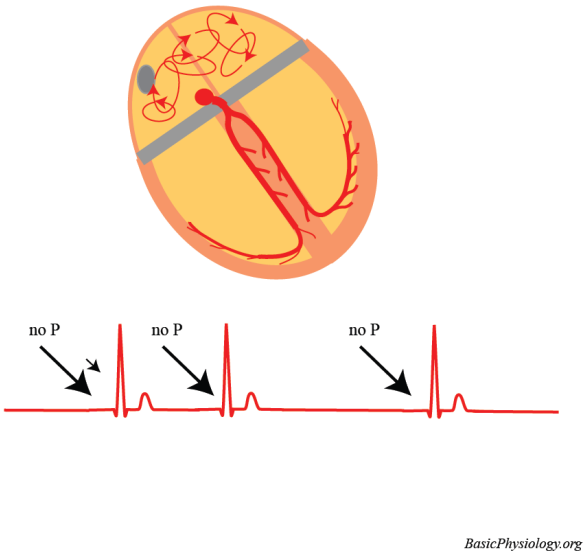
C. Atrial Tachycardia

1. An atrial tachycardia is caused by an ectopic focus that induces impulses at a rapid rate.	2. This repetitive focus can be located anywhere in the right or left atrium.
3. The polarity of the P wave and the PQ-interval therefore depends on the location of the focus.	
4. Often, the rate of the atrial tachycardia is lower than that of atrial flutter and every impulse does propagate through the AV-node and excite the ventricles, as in this case (diagram).	
5. Since the impulse propagates normally through the conducting system of the ventricles, the shape and polarity of the QRS and T-wave are normal.	

D. AV-nodal Tachycardia

1. In this type of atrial tachycardia, a re-entrant circuit is located in and around the AV-node!	2. These circuits can be quite **small**, mainly due to the very slow propagation in the AV-node (which produced the delay between the atria and the ventricles; *remember*?)
3. As in other re-entries, impulses will propagate from the circuit to surrounding areas, in this case both the atria and the ventricles.	
4. If the circuit is located high in the AV-node, then the PQ-time will be very short or the P-wave may even be hidden in the QRS complex (*top ECG in the figure*).	
5. If, however, the circuit is located low in the AV-node and close to the bundle of His, then propagation back to the atria will take a long time and the P-wave will occur after the QRS complex *(bottom ECG in the figure)*.	

E. Atrial Fibrillation

1. In atrial fibrillation, there are multiple re-entrant propagations simultaneously present, in the right and in the left atrium.	2. Therefore, some parts of the atria are constantly excited while others are recovering. All these excited and recovering areas shift all the time throughout the muscle.
3. As there is no longer one single propagating impulse, but many impulses, there is no longer a significant signal on the ECG and therefore no P wave, not even an 'F' wave.	
4. Occasionally, dictated by the long refractory period of the AV-node, an impulse will manage to propagate through the AV-node and excite the ventricles.	
5. Because these impulses propagate normally through the Purkinje system, the shape and polarity of the QRS and T-wave are normal.	